Functional Polymer Nanostructures on Surfaces

Stefan Zauscher, Duke University, DMR-0239769

Research: We develop patterning methods and fabrication strategies to build functional and stimulus-responsive polymeric nano-structures (Fig. 1). We use an arsenal of nanolithographic methods to pattern affinity templates for immobilizing initiator species for surface initiated polymerization of monomers. Our research is one of the first to combine nanolithography with surface initiated polymerization using atom transfer radical polymerization (ATRP) to fabricate nanopatterned polymer brushes (*Nano Letters*, 4, 373, 2004; *Chem. Mater.*, in press, 2004; *Adv. Materials*, submitted 2004). Recently we used anodization lithography combined with ring-opening metathesis polymerization (ROMP) to pattern polymers on SiO_2 surfaces (Fig. 2). We are now working with conjugated monomers which allows us to fabricate polymer nanowires, offering exciting prospects for patterning conductive nanostructures on surfaces.
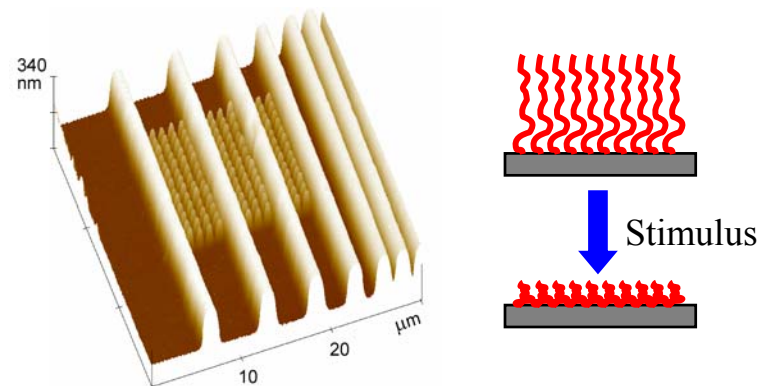

Figure 1. AFM TappingMode height image of pNIPAAM brush line micropattern (1.8 µm wide, 300 nm high) and dot nanopattern (600 nm wide, 170 nm high), fabricated using lift-off EBL and surface-initiated ATRP. Schematic: effect of an external stimulus on brush conformation.
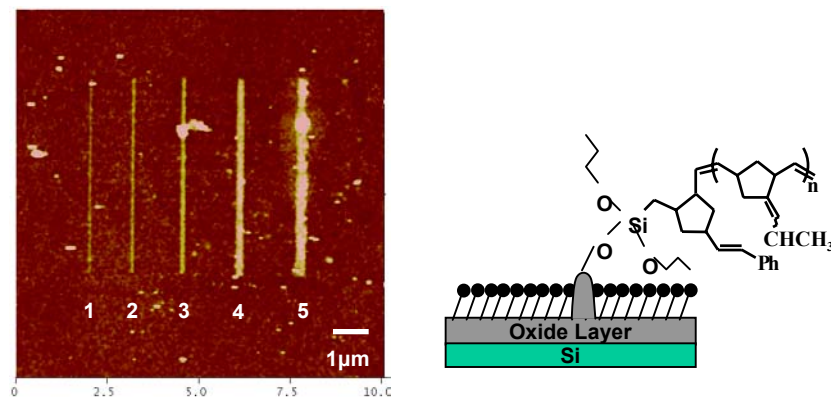

Figure 2. AFM TappingMode height image of poly-Norbornene lines grown by surface initiated ROMP (see schematic) on a SiO_2 surface.

Functional Polymer Nanostructures on Surfaces

Stefan Zauscher, Duke University, DMR-0239769

Education and Outreach: This effort currently involves two graduate students (Alexei Valiaev and Woo-Kyung Lee), and one postdoctoral researcher (Marian Kaholek). The CAREER grant currently supports two graduate students full time, and the efforts of one undergraduate student (Douglas Mullen) who is funded also through Duke's REU program. The grant specifically supports one REU each year for a hearing impaired student; and in the past two summers we were fortunate to have a student from Gallaudet University join our laboratory.

Figure 3. Zauscher Lab. Clockwise from left: Alice DeBellis (GS), Areej AbuLail (V), Nehal AbuLail (PD), Stefan Zauscher (PI), Alexei Valiaev (GS), Marian Kaholek (PD), Yee Lam (GS), and Woo Kyung Lee(GS). (GS = Graduate Student; PD = Post Doctoral Research Associate; V = Visitor; PI = Principal Investigator)